SCIENCE

NEW YORK, JANUARY 12, 1894.

SOME NEW JERSEY ESKERS.

BY G. E. CULVER, MADISON, WIS.

THE eskers here noted are found in the northeastern part of the State a little east of the valley of the Ramapo. The district embraced is about four miles wide and eight miles long. The series of deposits lies in a gentle depression extending from the point where the Ramapo enters the State, south to the neighborhood of Ramsey's, where it broadens somewhat and connects with other similar valleys, after which all turn southwestward and are noted as far as Wyckoff and Camp Gaw on the Susquehanna Railroad.

Besides the eskers proper there are here gravel sheets and bodies of various shapes, all more or less directly connected with the eskers.

The disposition of all these deposits is to keep well down on the sides or in the bottom of the valleys. Nevertheless, their elevation is not constant, and the eskers cross, at different points, small valleys and low ridges to some extent.

Of the eskers proper the three best are the Ramsey's, the Allendale and an esker beginning about a mile west of Ramsey's and running parallel with the Ramsey's esker.

These, with their branches, constitute a group not unlike a river system.

The Ramsey's esker is the central one of the group. It is also the longest and the best type of an esker. It begins north of the State line in the vicinity of Suffern, N. Y., and extends south to the neighborhood of Mahwah, where it is interrupted, and in its course are several flat-topped, delta-like deposits of precisely similar material, *i. e.*, loose textured sand and gravel. These deposits extend south of Mahwah about a mile and a half, at which point they cease, and the esker again becomes distinct and prominent. It crosses the Erie Railroad in the northern edge of the village of Ramsey's, then runs southwest for about a mile and a half, where it is again interrupted and is probably represented by various shorter branches or pieces of eskers extending nearly to Wyckoff.

This esker has its best development about a half mile southwest of Ramsey's, where it crosses about half a mile of low ground. It stands up clean and clear as a sharp ridge of gravel about twenty-five feet high and one to two rods wide on top. Its sides are as steep as gravel and sand will lie. Its course is sinuous, like that of a stream.

Besides the wide gaps which occur in nearly all of these eskers there are several narrow gaps, through some of which small streams now flow. In the case of the wide gaps the esker usually thins perceptibly, if not greatly, before disappearance, but where the narrow gaps are found the esker terminates abruptly on one side of the valley and begins as abruptly on the other. The resemblance to a railroad embankment where a stream is to be crossed by a high bridge is marked.

Present appearances indicate not that the stream has cut the gap in such cases, but rather that the gap was either never filled or else the material was removed while the ice was still near.

None of the eskers nor the associated deposits seem to have suffered much, if any, post-glacial erosion.

About a mile and a half southwest of Ramsey's a deposit is found which seems to have been made by the union of three small eskers which come in here.[1] It is an oval, rather flat-topped body of sand and gravel, covering, perhaps, an acre to the depth of twelve or fifteen feet. Two branches, apparently from the Ramsey's esker, come in from the north, another comes in or goes out from the southwest, while a fourth leads out to the south. The three first mentioned come from higher ground to the junction. The one going south descends from the junction, following the course of a small stream for about a mile, where it enters another and larger junction deposit, through which it connects with the Allendale esker. This second junction deposit is about a quarter of a mile long by half as wide, and rises forty feet above the eskers connecting with it.

It is steep-faced on the sides facing the lower ground, but seems to lap onto the higher ground on the northwest smoothly as though it were wedge-shaped. The thick end of the wedge lies toward the low ground, and the surface is quite level.

In all particulars save one this deposit is like the bodies of sand and gravel lying in the course of the Ramsey's esker south of Mahwah. Some of those are fifty feet deep, flat-toppod, steep-faced on the lower side and shade into the higher ground gradually. But they are not directly connected with an esker. The analogy, therefore, is not complete.

In the esker west of the Ramsey's esker occurs a feature which is perhaps suggestive in this connection.

This esker, after running as a sharp, well-defined ridge for more than a mile, in which distance it climbs about forty feet, turns sharply to the right, descends about thirty feet in less than half a mile, makes a broader turn into its former course and then gradually expands to fifteen or twenty times its former width, with a corresponding increase in the quantity of material deposited. It then narrows slightly and terminates abruptly, or rather is interrupted by one of the narrow gaps previously mentioned.

Beyond this gap it first widens and then narrows to to its original width—about a rod on top.

Here are three closely analogous types of deposits intimately associated with eskers. In topographic features they are practically the same, in material

[1] So far as I know this feature has not been before noted in connection with eskers, and hence no name to designate it has been suggested. In the absence of a distinctive name I have simply called them junction deposits.

and texture precisely so. All lie in the path of eskers. But they are differently connected with the eskers. The deposits south of Mahwah simply lie in the course of the Ramsey's esker, but are separated completely from it.

The junction deposits are connected directly with the eskers, but show decided differences of level as compared with the associated eskers. The Allendale junction deposit stands forty feet higher than either of the two main esker branches which unite in it.

In the third type we have the esker itself gradually widening out into a broad thick mass without marked change of level. In this case we have also the subsequent narrowing of the deposit to its original esker proportions.

If the first or Mahwah type alone were considered, perhaps the most natural inference regarding its genesis would be that a rapid stream had here debouched into the still water and there built the delta-like deposits.

Yet even in this group, which includes some half dozen of these gravel bodies, are several that can hardly be so accounted for, and in each of the other types it is clear that the material was brought to its present position by ice-walled streams.

In the case of the junction deposits it seems to this writer that a satisfactory explanation of their origin may be found by supposing that these deposits mark the points at which one or more crevasses in the ice intersected eskers. The radiating gravel ridges now mark the position of the intersecting crevasses.

That all these gravel deposits were made near the ice front is probable from the fact that a little farther south all the gravel is spread out in sheets. It is therefore reasonable to suppose that there were openings in the ice-front, bay-like in character, and that there were other openings within the ice border less directly connected with the open water along the ice border.[2]

The suggestion is offered, therefore, that these variously disposed bodies of esker material mark the places where openings of greater or less size had been formed by various agencies not far from the ice front and in the path of the ice rivers.

The streams would pour their contents into these openings. The water would escape, but the sand and gravel would accumulate in the openings until it either filled them completely or until new avenues were opened for its onward movement.

On the final melting of the ice the deposits of sand and gravel would be left resting on the till beneath, whether the streams which brought the material were subglacial or englacial.

[2]It is not meant here to assert that still water of any depth was to be found along the ice front at the time mentioned, although such might have been the case.

COLORATION OF THE RUFFED GROUSE.

BY J. H. BOWLES, PONKAPOG, MASS.

ALTHOUGH much has been written upon the two plumages in which our screech owl (*Megascops asio*) has been found, comparatively little has been *printed* concerning the variety of colors worn by the ruffed grouse (*Bonasa umbellus*), which seems surprising, as it is a favorite game bird. My experience has been with the birds of eastern New England (from Massachusetts northward), but I am inclined to think that the conditions are the same in other portions, for like the screech owl there is a red and a gray plumage.

Perhaps I can best explain my meaning by selecting three birds from a bag taken in this vicinity, as they show to perfection the three different phases seen in this species, viz.: gray, brown or red, and intermediate.

The breast feathers show comparatively little difference, but when the backs of the birds are compared the contrast is at once apparent. Taking the one in the gray plumage, which is the type found most commonly in Maine and the other northern parts, the fan of long tail feathers is of a decided grayish cast, the back, upper and lower tail coverts being of the same shade. (The tail coverts and back vary in intensity to a greater or less extent in individuals.) The ruffs are black throughout, with a strong tinge of iridescent green.

The next to be considered is the bird in the brown or red plumage, which is, from what I can learn, the phase more commonly found in the southern portions. Its fan is of a decided rufous tint, appearing in no way like that of the northern bird except for proportions and the transverse black bands. (These bands are almost always black, having a decided tinge of rufous in but *very* few cases.) The tail coverts and upper parts are also of a reddish tint, the ruffs being a strong brownish-red, tipped with dark brown, and tinged with iridescent brown. All things considered, the northern and the southern bird, when laid side by side, would hardly be taken for the same species.

Upon consideration, I am convinced that it would be impossible to show satisfactorily the third phase in one specimen. The upper portions of what I should consider the typical intermediate bird are what might be termed "pepper and salt," for the fan (always excepting the transverse black bands) is of a mixed red and gray color, the tail coverts and back being a medley of gray, dark brown and red. The ruffs may be either black or brown, for I have seen about an equal number of each. However, there is a wonderful variation, for I have taken birds having brown ruffs, back and tail coverts, yet with an almost entirely gray tail. This phase, like the preceding, is more commonly found southward.

The intermediate stage may, I think, be due to the inter-breeding of northern and southern birds, which meet at about the latitude of Boston, for they are found commonly on or near that line. As the ruffed grouse is greatly given to migrating, this theory seems possible. Another curious fact has become more apparent to me year by year, namely, that in the vicinity of Boston the birds in the red or intermediate phase are taking the place of those in the gray, until this season I have taken an average of three red or intermediate birds to one gray one, whereas in former seasons it was exactly the reverse.

In regard to nidification, I have not been fortunate enough to approach sufficiently near the birds on more than three nests to distinguish the color of their ruffs. Much to my satisfaction, however, one of these was red with brown ruffs, the other two being gray with black ruffs. Curiously enough, in both sets of the black-ruffed birds the eggs were light colored with very faint markings, while those of the red bird were larger with a darker ground color, most of them being thickly sprinkled with large, well-defined spots of reddish-brown. Of course this may have been purely accidental.

In conclusion I will deviate from the subject by giving my opinion that if the bounties were removed from owls and hawks, and put upon skunks, foxes and other vermin, our supply of game and song birds would be greatly increased; nor do I think that the farmer would suffer, in the aggregate, by such a proceeding. My reason for so thinking is the number of nests (including those of the ruffed grouse and oven bird) of eggs and young which I have found destroyed by these pests, not to speak of the number of birds killed after reaching maturity, which is comparatively small.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOLCANIC ROCKS IN THE KEEWATIN OF MINNESOTA.[1]

BY ULYSSES SHERMAN GRANT, MINNEAPOLIS, MINN.

THAT the Keewatin rocks northwest of Lake Superior are to a considerable extent composed of volcanic (effusive) material has been stated already by G. M. Dawson,[2] A. C. Lawson[3] and N. H. Winchell[4]. Although the material of much of the Keewatin in Minnesota has been assumed to be volcanic tuff and finely divided, water-deposited ash, the actual number of places where the rocks have been shown to be composed of such volcanic matter is very small. M. E. Wadsworth has described a few sections of fragmental volcanic rocks,--porodites,[5]— and N. H. Winchell has given an account of an agglomerate from Ely.[6] Aside from these the writer knows of no descriptions of rocks from the Keewatin of Minnesota that are clearly shown to be of volcanic origin.

In the neighborhood of Kekequabic Lake, in the northern part of Lake County, a rock has been found which proves to be a volcanic fragmental. It is in the midst of thick Keewatin strata,—argillites, graywackes, conglomerates, green schists, etc.,—which form the eastern extension of the Vermilion iron range. The rock under discussion varies much in general appearance, but is usually of a greenish color and very compact and tough. The groundmass is aphanitic and in it are numerous, lighter blotches and changes of color, between the blotches, and sometimes in them are black crystals of hornblende; pyrite is also quite common. In certain places rounded and subangular pieces of quartz and argillite are embraced in the rock. Parallel color-bandings resembling sedimentary laminæ also occur, occasionally quite abundently, but usually the rock shows no structural planes of any kind, nor any schistose or slaty cleavage. In thin sections the fragmental character of the rock is easily discernible. The fragments are usually angular, and their original nature is not always evident, owing to alteration and to the development of secondary minerals, but it seems that a porphyrite forms most of these fragments. The groundmass of the rock is largely fibrous hornblende. There are also areas of secondary hornblende, both in the groundmass and in the fragments, filling in old crystal outlines; what crystals originally filled these places is not clear, but it is probable that they were pyroxene phenocrysts. The rock thus appears to be a volcanic tuff completely solidified and more or less altered.

Closely associated with this volcanic tuff, and grading into it, are some peculiar green schists, which, like the groundmass of the former, are made up almost entirely of hornblende. That these schists are composed of water-deposited material is clearly shown by numerous laminæ, frequently running at an angle with the schistose cleavage, and in places by rounded quartz pebbles arranged in parallel lines. Under the microscope a section from these schists is seen to consist of closely crowded, green hornblende crystals embedded in a fine, fibrous groundmass also made up of hornblende. The crystals are, in short, stout prisms, averaging about a quarter of a millimetre in length. They are commonly, not completely idiomorphic; the prismatic planes are very generally quite distinct, but the terminal faces are not so often well developed. The ends of the crystals often show fringes or fibrous prolongations running out into the groundmass. At times these fringes are sharply marked off from the crystal proper, being of a lighter color, but the fringe on each crystal is optically continuous with it. These fringes closely resemble the secondary enlargements of hornblende grains and crystals described by C. R. Van Hise[7] and are probably of a similar nature. As to just what was the nature of the sediment which formed these green schists, it is impossible to decide, but there are several reasons for regarding it as chiefly finely divided, water deposited, volcanic ash now entirely recrystallized.

In the immediate neighborhood of the tuff and green schists is a small area of a fine-grained, purple, porphyritic rock, which proves to be a hornblende porphyrite. This has distinct, elongated phenocrysts of brownish hornblende imbedded in a completely crystalline groundmass of interlacing feldspar laths; in places this groundmass becomes almost granular in structure. From its known relations to the surrounding rocks, the completeness of its crystallization and the absence of structures common to effusive rocks, this porphyrite appears to have never reached the surface, although such a degree of crystallization might possibly have been attained in the centre of a very thick flow.

It seems probable, then, that in Keewatin (Lower Huronian, as that term is used by the United States Geological Survey) time a volcano existed in this locality, that it furnished the deposits of tuff and ash described above, that its lava was of about the composition of hornblende porphyrite, and that the present known mass of porphyrite represents a part of the igneous magma which solidified below the surface.

A more complete account of these volcanic rocks and the surrounding rocks, especially of an interesting augite soda-granite, concerning which a preliminary note has already been published,[8] will appear in the forthcoming twenty-first annual report of the Geological and Natural History Survey of Minnesota.

[1] Published by permission of the State Geologist of Minnesota.
[2] British N. A. Boundary Commission, 1875.
[3] Geol. Surv. o Canada, vol. iii, pt. i, 1888.
[4] Geol. and Nat. Hist. Surv. of Minn., 15th Ann. Rept., 1887; 16th Ann. Rept, 1888; Bull. No. 6, 1891.
[5] Ibid.; Bull. No. 2, 1887.
[6] Amer. Geol., vol. ix, pp. 359-368, June, 1892.
[7] Amer. Jour. Sci., III, vol. xxx, pp. 231-235, Sept, 1885.
[8] Amer. Geol., vol. xi, pp. 383-388, June, 1893.

—In view of the present interest in German politics, social and political life, and educational affairs, the new work, "Germany and the Germans," by William Harbutt Dawson, is timely. Mr. Dawson, who is well known as the author of "German Socialism and Ferdinand Lassalle," and "Prince Bismarck and State Socialism," has made a close study of German life and institutions at the present day, and the results of his observations are set forth in an interesting manner. "Germany and the Germans" will be published immediately by D. Appleton & Co.

CURRENT NOTES ON ANTHROPOLOGY.—XXXVII.

(*Edited by D. G. Brinton, M. D., LL.D., D.Sc.*)

ART IN ANTHROPOLOGY.

THE student of anthropology must be delighted to see how it is enriching learning in all directions by supplying the material from which can be derived the laws for the development and acquisition of knowledge—that which the Germans call *Erkenntnisslehre.*

In few directions has there been greater need of this than in the domain of art. We have had abundance of histories of art, and some efforts toward systems of the philosophy of art; but a science of art, something which would show us the laws which prevail in, and govern, the apparently so irresponsible and capricious development of art,—this has been wanting.

An admirable effort to supply this deficiency has recently been published in Leipzig under the title, "The Beginnings of Art" (*Die Anfänge der Kunst*), by Dr. Ernst Grosse. It is a manageable volume of 300 pages, in an attractive style, enriched by a sufficient number of illustrations. The author understands art in its broad sense, including music, poetry, painting, sculpture, ornamental design, dancing and cosmetics. In all these directions he examines the conditions and influence of primitive art, and its social and individual significance The conclusion which he reaches is one most significant and pregnant with suggestion, to wit, that certain definite and absolute relations exist between given forms of general culture and the growth of the arts which accompany them; though the hidden psychical forces which underlie the laws of these relations may and generally do remain obscure or unseen, the fact of the relation cannot be denied.

The volume is worth a careful study.

THE ANCIENT KINGDOM OF THE HIMYARITES.

IN the early Greek and Roman geographers southern Arabia is referred to as "Arabia Felix" and described as "a fortunate land, odorous with spices, and abounding in gold and ivory and all manner of precious stones." When its majestic Queen visited King Solomon "no such spices as the Queen of Sheba brought had been known in Jerusalem."

How does it happen that that land is now, and for a thousand years has been, a barren waste? That its ancient palaces are choked with sand? Its gardens and spice groves given way to the arid desert? Some fatal change in climatic conditions, a destructive increase in exsiccation, may be the cause. Only in the last few years, owing to the researches of Glaser, and later of J. T. Bent, are we in some measure able to restore the faint outlines of that wondrous kingdom, which for nearly a thousand years was the medium through which the gold of south Africa, the frankincense of Abyssinia, the diamonds and spices of India, passed to the wealthy nobles of Egypt, the dealers of Tyre and Sidon, and the peoples of the Mediterranean.

The great Zimbabwe ruins in Mashona land, the venerable temples near Aksum in Abyssinia show by their plans, and the latter by inscriptions as early as 800 B. C., that they were colonies of the Himyarites.

What a mighty influence this trade exerted on the ethnography of east Africa and India and all the intermediate regions, we can readily imagine. It is enough to explain the strange discovery of M. Dieulafoy, at Susiana, that that ancient realm had a large population of African negroes. We need no other theory for their presence than this trade of the early Arab merchants, who brought then, as they do to-day, their dhows loaded with human freight from the teeming shores of the dark continent, to dispose of them among the whites of the Asiatic main.

HUMAN RELICS IN THE SAN ISIDRO GRAVELS.

IN the Museum of the University of Pennsylvania is a chipped stone implement which about a year ago was found in place, and extracted with the most scientific precautions, by Mr. H. C. Mercer, one of the curators of the Museum, from the gravel bed of the River Manzanares, at San Isidro, near Madrid, Spain. It is peculiarly valuable because these gravels are held to belong to the Palæolithic or oldest stone age. It was exhibited and described by Mr. Mercer before the American Association for the Advancement of Science at Madison, last August, and it is a well-marked type of a most ancient implement.

The same locality has been made the subject of an excellent paper by the Baron de Baye, in a late number of the Bulletins of the Anthropological Society of Paris. He refers quite fully to the literature of the subject, and imparts a considerable amount of new information from M. Siret, the Belgian engineer, well known for his admirable researches into the archæology of Spain. The objects belong to the "Chelleen" and "Mousterien" types of the French archæologists, which would put them back to the very beginning of human industry.

Unfortunately, the bones which have been taken from these gravels have not received careful examination, so from them we cannot define the age of the horizon. It is quite certain that these beds were not deposited by the Manzanares, but by a much larger stream running in a different direction. The physical geography of the district has undergone profound alterations since they were stratified. The station is one of the first in importance and merits a thorough investigation.

THE MOCOVI LANGUAGE.

STUDENTS of American languages, especially of those of South America, will welcome with much satisfaction the appearance of the collection on the Mocovi, edited for the Museo de la Plata, by S. A. Lafone-Quevedo.

It is largely based on the MSS. of Father Tavolini, an Italian missionary, but is by no means confined to these. The editor begins with a learned essay on the comparative linguistics of the Chaco languages, and in his notes brings forward much other information from the writings, in part manuscript, of Barcena, Dobrizhoffer, Pelleschi, and others. From these varied sources the diligent student will find in the volume, which altogether makes up more than five hundred large quarto pages, abundant material from which to acquaint himself satisfactorily with this little-known tongue.

In this connection, it is pleasant to note that the attention to American languages is slowly on the increase. Among the "Conferences" published in 1893 by the Atheneum of Madrid, was one of 112 pages on American linguistics by Don Francisco de Fernandez y Gonzalez, which is marked by a creditable acquaintance with the literature of the subject; and in the Anales de la Universidad, of Santiago, Chili, there is a well-prepared article on "La Linguistica Americana, su Historia y su Estado Actual," by Diego Barros Arana and Rodolfo Lenz. Several works have also been announced in Germany and France, which show that the scholars in those countries are awakening to the large scientific interest which these languages have.

SECRET LANGUAGE OF CHILDREN.

BY OSCAR CHRISMAN, CLARK UNIVERSITY, WORCESTER, MASS.

Two parties having seen the article in *Science* of Dec. 1 have sent me the secret languages of their childhood.

William M. Gregg, M. D., No. 143 West Twenty-first street, New York, sends the following:

"Olafoscarlafar Crilafistelafamalafan:

"Halafavilafing olafobserlafirved alafan artafartilafecalafal ilafin *Silafialafance* olafon 'Selafecalafrete Lanafangalafage olafove Chilafreldelafrend,' ilafi ilafinclolafose thilafis notafote tulafu alafask ilafif oolafue halafave elafeverlafer selafene elefennelafeny lilafike ilafit."

The translation of the foregoing is:

"Oscar Chrisman:

"Having observed an article in *Science* on 'Secret Language of Children,' I inclose this note to ask if you have ever seen anything like it."

Dr. Gregg states that he has not used the language, except to himself, in over fifty years. He thinks it must have originated in his family, or in the neighborhood, at Elmira, N. Y., where he lived when a child. He and his younger brother became most proficient in the use of this language, although all the members of the family understood it, being used by them for ten or twelve years. The spelling of the words is quite arbitrary, the principal object being to disguise them as much as possible. Sometimes words were contracted, as in *yalafas*, for *yes*, *fas* was simply used, leaving off the *yala*. When the language is well spoken it sounds somewhat like Hebrew.

Miss Martha L. Sanford, No. 21 Oread Place, Worcester, Mass., furnishes the following:

"Concerning the 'secret language,' Hog Latin, or rather the particular form of the dialect I knew, perhaps some concrete examples may be best, for instance: *Cagry yougry uggry stagry Hogry Lagry?* meaning, Can you understand Hog Latin?

"*Igry wegry dowgry towgry thigry morgry.* I went down town this morning.

"*Itgry igry raigry horgry nowgry.* It is raining hard now.

"*Wegry shagry hagry agry greegry Chrigrymagry, Mrigry Praggry sagry.* We shall have a green Christmas, Mrs. Pratt says.

"In order to represent the sounds I ought really to use the diacritical marks, since in writing the language (which I think I never did before, since it was, so far as I know, always a *spoken* means of communication) the same combination of letters may represent more than one word; for instance, *wegry* may mean *went*, *we*, *well*, *wet*, and so on. Of course, the sentences we composed were usually simple, and if the hearer failed to comprehend a word, it could be made plainer by simply adding the syllable *gry* to the word, as, *wetgry*, *wentgry*, etc."

It is pleasantly surprising that these two parties should each have furnished me something in secret languages which I had not met with before in my study.

Dr. Gregg gives the following numbering connected with his "gibberish," as he calls it:

"1, unzol or unica; 2, zulzol or ureica; 3, ziczol or irick; 4, zan or an; 5, filize; 6, falize; 7, niczol-tan or nicholastan; 8, minzol; 9, tinzol; 10, hoppzolan or hip.

"The above are the numbers which were used in connection with the gibberish I have sent you. It may possibly be derived from some nursery rhyme, as you will observe that it has a sort of sing-song about it."

Miss Sanford sends this small scrap of a cipher alphabet. I do sincerely hope she may get the whole of it, as, if I recall correctly, otherwise than in her note I have not met the least intimation of any cipher being used, and, also, this so well shows the wonderful ingenuity of children:

"With two or three intimates I arranged a cipher alphabet, using such symbols as ∞, ꟻ, for letters, and I think I have, packed away in California, some scraps of our correspondence, but unfortunately they are at present unobtainable."

I wish to make a collection of the secret languages of children, so I have asked the editor of *Science* to be kind enough to insert the following:

1. Please look back into memory and see if you have traces left of secret languages.
2. How old were you when you used such? How long since?
3. In what city, town, or district were you living at the time you used these languages?
4. What did you call it?
5. Was it written, spoken or both?
6. Did you use special characters to write it? If so, give them.
7. Was the language pretty generally used or was it known to only a few?
8. Did the language originate with you or your schoolmates? If not, trace it as far as you can to its origin.
9. What is the special catch in the language; is it a syllable, a letter, an alphabet, or something else? Give it.
10. Write a sentence of not more than *twenty-five* words in your secret language, then immediately following give the words in the regular English.
11. If other points come into mind not touched upon by the queries above, give them.
12. If you can learn of a secret language being used now by children it will be of the very greatest interest and benefit to gather it up.
13. In writing down the secret language be careful to make your letters very plain, and go over it again and again to be sure that your words are spelled as you want them.
14. You may be aided in gathering and writing your language by reading my article "Secret Language of Children," in *Science* for Dec. 1, 1893.

If the readers of this will be kind enough to collect such material as they may find in memory or from notes or from children and send to me, I shall be truly thankful, as I wish to continue my studies on the secret language of children, and your aid will be of great service

WERNER'S REAL CONTRIBUTION TO GEOLOGY.

BY J. B. WOODWORTH, CAMBRIDGE, MASS.

PROF. G. H. WILLIAMS did a service to his generation by recalling to mind, at the Boston meeting of the Geological Society of America, the contributions to North American geology made by Johann David Schoepff. It would be a very useful thing for the student of philosophical geology to have at hand a thesaurus of first authors or originators, arranged somewhat after the plan of theories of mountain building compiled by the late Alexander Winchell in his "World Life." A work of this kind would place credit where it belonged, and would, if carried out on a comprehensive plan akin to Gilbert's "Classification of Geological Phenomena," present the state of geological theory in the different departments of the science. The case of Abraham Gottlob Werner illustrates the need of such a handbook.

Werner was born Sep. 25, 1750, and died June 30, 1817. He is justly celebrated for his influence upon geology, but the prominence which the erroneous theory he propounded gave him in the controversy between the Vulcanists and Neptunists has led, as Professor John Phillips has stated, to overlooking his real contribution to geology. "We must forget his theory," writes Phillips in his sketch of the progress of the science, "and view only the data which he collected for its foundation." Sir Charles Lyell, in the admirable résumé of the history of geology, which he gives in his "Principles," does not credit Werner with the development of the principles of studying rock structure, on which the success of the field geologist depends. Phi

lips gives two principles as the basis of Werner's system:

1. "When two veins cross, and one of them cuts through the other, the one which is divided is the more ancient."

2. "In effect, among superimposed stratified rocks, the lowest was deposited first and is the oldest."

Lehman, it seems, worked out these principles in part before Werner, but he fell short of his countryman in the extent of their application and significance.

By the first of Werner's laws, we determine not only the relative time of occurrence of veins and dykes, but also that of faults, joints, brecciation and other minutiæ in modern petrographical investigations with the microscope. In the same category of contact phenomena might also be placed unconformities, the importance and use of which have only within a few years been fully elaborated by the geologists of the Lake Superior district.

The second of Werner's generalizations is to stratigraphic geology what the first is to the study of igneous rocks and secondary structures. How these, to us seemingly obvious, laws are used in modern geological instruction and field investigation is seen by Professor Davis's paper on "Instruction in Geological Investigation" (in *Am. Nat.*, xxi., 1887, pp. 810-825). One essential advance is in recognizing what Hutton insisted on, the intrusive origin of the igneous rocks, and in interpreting unconformities, but our method of diagnosing a field of outcrops or the structure of a mine is that which Werner pursued with his classes a century ago.

HABITS OF THE PURPLE FINCH — *CORPODACUS PURPUREUS*, GRAY.

BY M. W. VANDENBURG, FORT EDWARD, N. Y.

The pleasant articles contributed to *Science* by Dr. Morris Gibbs, on "Birds and Bird Life," have reawakened observations often made by me on the habits of this spirited little songster. Some of these habits are, in so far as I know, unique; others are rarely found in other species, while still others are common to many species.

In its arrival from the south the purple finch often divides honors with the song sparrow, and pours forth from the top of some tall naked maple or elm such a voluble, rattling, exuberant song it seems as if he must needs sing or burst. This, too, while fields are white and winds blowing keen. In ten days or so, the females appear in twos, threes or fours. In the little flocks, if so few as six to ten can be called a flock, every one goes as he or she pleases, though they always keep in sight of each other, or in hearing of the sharp "chick" call-note.

Soon as the days grow mild, and snow leaves the fields, mating begins; and now comes the strange part of the story. The females sing as well as the males, and, what is more, the full round of the "set song." That is, the purple finch has a full, regular song of a certain number of notes (words), always repeated in the same order, and with very rare variations from this order. It is repeated very rapidly in a loud, high-pitched key, and ends very abruptly in the early spring song of the male, and always so in the song of the female. In the later spring song of the male, there follows the loud song, a very soft tremulo strain containing, it always seemed to me, a mimicry of the notes of other birds, among which one may detect one or two words from the pee-wee. This *sotto voce* song finally dies out as if he had forgotten the last notes, and often ends with a little whistle.

The female never aspires to this part of the song. Her song is a signal for all the males to assemble, and then the rapid fighting begins. The female downs fiercely every male who dares approach her, but is very lenient towards her own sex. So vicious and vigorous are her attacks that the male usually gives her a wide berth and keeps his eye quite as much on the avenue of escape as on her comely figure. This is no mistake of mine. It is not the song of an immature male.

And this is why I know I am correct. For several years I had a pair of these birds in a cage, where they were reared from the time they left the nest. On the approach of spring, say about the last of February or first week in March, the birds became very restless. They both began to sing; they grew very quarrelsome and constantly indulged in the fiercest brawls. Wilson says: "They appear to be of a tyrannical and domineering disposition," and not an hour passed in the day that did not demonstrate the correctness of this observation.

From being perfectly peaceful and considerate of each other, they grew so quarrelsome, so persistently pugnaceous, that they disturbed the whole household, and often the cage had to be covered over to lessen the bickering. In these first days of war the female was always victor, and she was wholly merciless. Later on her courage gradually failed, and by the end of a month or six weeks they ceased to fight, the male having won the day. He would "boss the household" for a week or two, with a pretty firm hand of authority, but not until many a well-fought field had been lost and won for days and days in succession.

They could never be pursuaded to build a nest. The female would lay from three to four eggs in the cage bottom. For one or two seasons a second laying succeeded, but this was not usual.

In the wild state the male never approaches the nest. He alights on a tree six to ten rods away and rapidly sings his full, *loud* song once or twice. The female answers him with a low call-note, leaves the nest and he feeds her from his "crop" in the same manner as the yellow-bird feeds its young. This done, he takes a hurried leave, and she returns to the eggs.

When the young first hatch this process continues, and the mother feeds them from her own crop, after being supplied by the male. Later on the male seems to forget his family altogether, or to feed the mother rarely and at a greater distance from the nest.

In the end, the whole care of the family seems to devolve on the female, and the ungracious sire never recognizes in any way his legitimate offspring.

I do not know whether the female sings previous to the second nesting or not, but would think it probable that such was the case for a few days at least.

I have met with unmated females singing as late as May or the first of June. The mated female, who no longer tolerates such giddiness and waywardness in a sister, pursues the singer with all the vim and viciousness she can command.

The male, too, not infrequently comes in for a bluff rebuke, if he is not discreet in his attentions to the coy spinster.

Such have been my observations of the purple finch, extending over a period of thirty years. They are in the main correct, as it seems to me, for they have received confirmations during every year of that time.

JEWS AND HITTITES.

BY FELIX VON LYSCHAN, BERLIN, GERMANY.

OUR modern Jews are generally believed to represent a pure and typical branch of the Semitic race, and even authors, who are well aware that we find mixed blood on the remotest and apparently most isolated islands of the Pacific, seem inclined to admit an exception for the Jews. It seems of interest, therefore, to study Jewish types, not only as to their general impression, but by measuring their heads and skulls and comparing them with other representatives of Semitic nations. The result has been a most striking one.

As Semitic races, or as others prefer to say, as branches of the Semitic race, we generally consider the Babylonians, the Assyrians, the Hebrews, the South Arabian Sabæans, the Phenicians, the Aramæans, the Abyssinians and the Bedouins of northern Arabia and of Mesopotamia. Now, the anatomical characteristics of these eight people, which all are, or have been, speaking typical Semitic languages, are most divergent; only the Bedouins, wnose language also is remarkable for its very archaic character, seem to form a homogeneous unity, with little mixture of strange elements; their modern physique is the same as we see it represented in the earliest Egyptian monuments, and also our earliest skulls of Phenicians seem identical with old and modern Bedouin skulls, so that we must consider the modern Bedouins as pure descendants of the old Semitic race. They have long, narrow heads, dark complexion, and a short, small and straight nose, which is in every respect the direct counterpart of what we are accustomed to call a "typical Jewish nose." But of our modern Jews nearly 50 per cent are brachycephalic, 11 per cent have fair complexion, and not more than 5 per cent correspond to what we have learned to be the real old Semitic type. Still more striking proportions we find, if we go to northern Syria, the land of the old Aramæans; there nearly all the heads are brachycephalic, with indices near to 90; and these same brachycephalic elements we find everywhere in western Asia; we find them, more or less prominent, even with the modern Greeks, Armenians and Turks of Asia Minor, and specially the Armenians are most remarkable for the nearly complete uniformity of their types, for their dark complexion, for their extreme brachycephalism and for their large and hooked "Jewish" nose.

Such and other investigations lead us to the conviction that Syria and Asia Minor were in early times inhabited by a homogeneous and extreme brachycephalic race, of which modern Armenians are the nearly pure descendants, and which we find more or less mixed with strange elements, in many of the other races that now inhabit western Asia. This old brachycephalci race, which from its beginning was utterly distinct from any Semitic tribe and was in physical view the very counterpart of the Semites, can only be identified with the Hittites—the same Hittites mentioned as a Syrian tribe in the Bible, which had been a strong and formidable enemy to Ramses II., and were finally conquered by Assyrian Kings in long wars and fights, beginning earlier than the times of Assurnassirpal and ending probably only in those of Asarhaddon, as we read in the Assyrian annals from the ninth century to the seventh century, B. C.

Recent excavations, made for the Prussian government in *Sendjirli*, the old Sammâl, known in Assyrian texts as a Hittite residence in northern Syria, have brought to light a large series of old Hittite sculptures; the Armenian character of the men represented on the walls and in the royal palaces of this old town is most striking, and we cannot err if we consider the inhabitants of Sammâl as the direct ancestors of the modern Armenians, which still inhabit the neighborhood of the place, ill-treated in our times by Turks and Kourds and without any knowledge of their glorious history in ancient and mediæval times.

Hittite sculptures are often found connected with a very curious, heavy and bulky looking sort of hieroglyphic inscriptions, which are not yet finally deciphered, but are now getting more and more familiar to us, thanks to the investigations of A. H. Sayce, Peiser and Peter Jensen. We have no reason to doubt that these hieroglyphs were the only sort of writing known to the Hittites in early times. Now it is a curious fact that two inscriptions were found, written by native Kings, the one in the ninth, the other in the eighth century, B. C., both in good old Semitic alphabetical characters, resembling closely the famous inscription of Mesa, King of Moab, and in a language that might be called proto-Aramæan or proto-Hebrew, but which is anyhow old Semitic, and can well be compared with the language of some parts of the Bible. So the inscriptions I found in Sammâl[1] show that already in the ninth century, B.C., Semitic influence was great in northern Syria, and we can now easily understand how Semitic writing and language soon became dominant among people of western Asia that were originally without a drop of Semitic blood; and then we understand also why most of our modern Jews have the Armenian type and not the Semitic—they are the descendants of an "Armenoïd" population that had only accepted Semitic writing and language in about 1000 B. C.

This is a similar process to what we know for Asia Minor, where millions of the native population were by force converted to the Islâm, and, having accepted also the language of their Turkish conquerors, are now generally taken as real Turks, though their blood is nearly free from Turkish influence and though they can well be considered as the true and pure descendants of the old natives of their country.

But one thing still remains to explain in the habitus of the modern Jews; it is the fact of 11 per cent of Jewish individuals with fair complexion and light eyes. All the various theories of recent mixture with Germanic elements would never sufficiently explain this curious fact; we are forced to look out for an *old* origin of the fair complexion of more than one-tenth of modern Jews, and we find it in the intercourse of the old native Syrians with the *Amorites*, the tall "sons of Enak" of the Bible, who were fair, with blue eyes, as old Egyptian painted monuments show us. We are not quite sure as to the real home of these fair Amorites, but they were probably a branch of the same fair race that once inhabited also the northwest coast of Africa, which has left there the megalithic monuments and is most certainly to be identified with the *Tamchu* of the old Egyptians, the white "people of the north" as their name explains. The Amorites would then be good fair Aryans, not in the linguistical meaning, as "Indo-Europeans," but in the strict sense of physical anthropology.

So we see in our modern Jews the descendants of three different races, the Hittites, the Aryan Amorites and the Semitic nomads, immigrated into Syria only in about the times of Abraham.

[1] Ausgrabungen in Sendschirli, Heft I. Berlin, Spemann, 1893.

THE DEPARTMENTS OF GEOGRAPHY.

BY HUGH ROBERT MILL, D. SC., LONDON.

THE sub-division of any portion of science must be largely empirical, and in accordance rather with practical convenience than with natural planes of cleavage. Thus we are accustomed to such phrases as mathematical geography, physical geography, astronomical geography, ancient geography, political geography, and the like, although it would be very difficult to piece together the fragments which pass under these names so as to make up a coherent geography. In endeavoring to sub-divide the content of geography in such a way as to bring out the natural interrelations of its parts and their logical sequence, for purposes of exhaustive study, it has occurred to me to represent the whole metaphorically by a pyramid of several courses of masonry differing in material and finish but each supported by those below and supporting those above. Thus the fundamental course would be mathematical geography, constructed of great blocks hewn from the quarries of the only absolute science, accurately squared and fitted. It includes all that has to do with exact measurement of space and time and motion, the form and dimensions of the earth, its motions and the construction of maps. Upon this base is reared the second tier, physical geography, the material for which, less homogeneous and perfect than the foregoing, comes from quarries scattered over the realms of many sciences, from chemistry, physics and the different departments of geology, from meteorology and the science of the oceans. It is concerned with all these phenomena which depend on differences of substance, structure and state, and accounts for the origin of surface features and of scenery, the interactions of lithosphere, hydrosphere and atmosphere and the effect on each of solar energy. Next in order and less regular in structure, dependent on physical geography as physical is on mathematical, I place bio-geography, wherein the influence of life is taken into account. This serves to explain how vital processes of plant and animal affect the structure of the earth, and how the lifeless features of the globe regulate the distribution of vegetation and of animals. Arising directly from this floor, but as yet only imperfectly put together, is the course of anthropo-geography, the elucidation of the action of mankind as an animal species upon the globe. The unit of consideration is mankind as a whole; the variety of races, conditions of life and density of population are the features taken into account, and the interaction between man and nature has to be studied in its widest aspects. The changes in the relation of different tribes to their habitat belong to this zone, and these changes are the basis of historical geography, which gives origin to the next tier of our pyramid, in which the influence of races of men on the earth finds a place. This may be termed, for lack of a better name, political geography; its units are uncertain and transitory, for the hold of nations on regions is subject to continual change. But political geography is stability itself compared with the rough pile of commercial geography which caps if it does not crown the edifice. Here it is no longer the racial or national view-point which determines the conditions, but the individual greedy of gain or struggling for life. The distribution of natural resources is the fundamental condition, and the national frontier has rarely much in common with the political.

But here a further simile must be brought in. This cap of the pyramid plays the part of a keystone as well, and binds the whole structure together. As rain filtering through a mass of brick or stonework dissolves the mortar of the upper parts, and redeposits it in the lower courses, so the stream of self-interest permeates the whole structure of geography, and its results are felt throughout. Commercial motives consolidate national life, accentuate racial differences, redistribute animals and plants, modify physical conditions, start investigations into the nature of the earth, and even invade the solid groundwork of mathematics with the practical counsels of common-sense.

There are many people, but there were more, who deny to the sphere of geography anything beyond the measuring of distances and the mapping of distributions. The legitimate scope of the science, however, includes very much more, and the simile which I have sketched may help some students to understand and some teachers to apply the principles of geography.

THE AGE OF THE IRON ORES OF EAST TEXAS.[1]

BY WILLIAM KENNEDY, AUSTIN, TEXAS.

EXTENSIVE deposits of brown iron ore, or limonite, occur throughout east Texas, from the State line westward to the Brazos River, and covering a roughly irregular triangular area, having its base resting upon the Sulphur Fork of the Red River across the northern side of Cass County and extending westward until the apex touches the Brazos.

Regarding the age of these deposits considerable confusion appears to have arisen. In the Tenth Census Professor Pumpelly assigns them to the Quaternary. Why this age was given to these ores is not stated. They simply appear among the Quaternary deposits in the Texas section shown on plate VIII., of the fifteenth volume, and no mention is made anywhere in the text of any authority for so placing them. As the only Texas ore of which any notice is taken in this volume is that found in Marion County, and then worked in the Kelleyville furnace, it may be presumed that, as that ore is of the nodular variety and corresponds very closely in physical appearance and approximately in chemical composition to the ores found in Mississippi by Dr. Hilgard and described by him as belonging to his Orange Sand formation, and consequently of Quaternary age, Professor Pumpelly considered the Marion County ores to have the same origin and date, and so placed them in the Quaternary when making his section.

The next investigator was Mr. Lawrence C. Johnson, an Assistant on the United States Geological Survey. Mr. Johnson had been assigned to make an examination of the iron ores of northern Louisiana in 1885, and in 1886 his instructions were modified and extended so as to enable him to examine the east Texas deposits. This investigator appears to have been the first to recognize the existence of two divisions among the ores. These he separated, assigning the name of *nodular* ore to the one variety, and by the term *lacustrine* designated the other. This latter class he again divided into "laminated" and "buff crumbly" ores, according to their texture and physical appearance.

While dividing the ores into these two great divisions, he at the same time placed them in different ages and under entirely different conditions. The nodular ore, Mr. Johnson considered as belonging to the lignitic Tertiary, and we find him, after describing the ores of Marion County, saying: "All this portion of the iron field, including Upshur, Camp, Morris, Marion and Cass Counties, is assigned to the great Lignitic of the Geological Column." (Iron Ores of Northern Louisiana and Eastern Texas, Ex. Doc. 195, first session, Fiftieth Congress, p. 34.)

[1]Read before the Texas Academy of Science, Dec. 16, 1893.

The laminated ore, or, as he described it, the lacustrine ore, Mr. Johnson appears to place in the Quaternary, as, after describing the conditions and modes of formation and deposition of such ores, he says: "Such deposits were produced at various stages of the Quaternary history of the regions under consideration, and some of them possibly during the Tertiary, and now that the strata are exposed to erosion, the hard insoluble limonites resist it more successfully than the unconsolidated sediments in which they occur; the softer rocks are therefore swept away, and the iron deposits remain upon elevated plateaus or buttes."

Mr. Johnson also appears to have recognized the existence of the extensive deposits of conglomerate ores, but of these it is unnecessary to speak. They belong to every age, from the Eocene Tertiary to the present. In point of fact, many of them are still forming.

In 1888 the Geological Survey of Texas was established and the east Texas division assigned to Dr. Penrose. This area included the whole of the ore regions examined by Johnson. In his views regarding the age of the ore deposits, as shown in his "Preliminary Report on the Gulf Tertiary of Texas," Dr. Penrose appears to agree with Johnson as to the age of the nodular ores being lignitic Tertiary, but the whole of the laminated ores he places, and rightly so, in the glauconitic or Claiborne Tertiary. In a recent report on the iron ores of Arkansas Dr. Penrose again refers to the east Texas ores as follows: "In eastern Texas, where the geologic position of the Tertiary iron ores is more easily defined than in Arkansas, two principal divisions of the Eocene contain noticeable quantities of ore; the lower one is the great series of sands and clays, which forms the central part of the Eocene (the Timberbelt or Sabine River beds of the Texas section); the upper one is the Claiborne glauconite that overlies these beds." In this report Dr. Penrose compares the Arkansas ores to the Texas nodular ores and places both in the lignitic (Report on Iron Ores, Geological Survey of Arkansas, Vol. I. of 1892, pp. 105–6).

Numerous and careful examinations of these ore deposits throughout a great portion of east Texas and particularly in Cass, Marion, Morris, Upshur and Harrison Counties, the regions in which the nodular ores are most extensively developed, have convinced me that these nodular ores do not belong to the lignitic stage of the Eocene, but rather that they are of the same age as, or probably a little newer than, or derived from, the laminated ores, which, according to Mr. G. D. Harris's determination of the fauna, are of lower Claiborne age.

Without entering into any discussion as to the geological conditions of the ore regions, it may only be necessary to say that the lignitic and glauconitic divisions are both represented in the regions occupied by the nodular ores. The characteristic features of each are so distinctly marked that there is nowhere the least difficulty in separating or distinguishing the one from the other. The uppermost number of the lignitic stage is a series of thinly stratified or laminated white and red sands and sandy clays, the laminæ rarely exceeding half an inch in thickness and having, wherever exposed, a thin covering, or uppermost lamina, of silicious iron or ferruginous sandstone from a half to one inch in thickness. These sands have not always this ribbon-like banding but occasionally, through an intermixture of the colors, present a mottled appearance. This condition is usually confined to the vicinity of streams.

The lowermost deposits of the Marine stage of the Tertiary or glauconitic deposits are usually coarse greenish or brownish-yellow colored indurated sands or sandstones. Occasionally these deposits are dark brown and usually without fossils, although not unfossiliferous throughout, but wherever found the fossils exist only as casts and are chiefly *Cardita planicosta* and turretella. These deposits are, as a general thing, ferruginous and carry laminated iron ore in thin seams, not only interstratified with the beds of sand and sandstone, but often filling joints and fractures running in different directions through the beds. No ore of any economic value, however, is found associated with them. The base of these glauconitic sands and sandstones rests directly upon the uppermost white and red sands and clays of the lignitic and marks the limit below which no ore of any quantity or value has yet been found in any portion of east Texas.

The general assumption of the nodular ores belonging to the lignitic by both Johnson and Penrose appears to have arisen from the idea held by both that the regions in which these ores occur in greatest abundance are altogether occupied by the clays and sands of that series. While it is true that the deposits of the lignitic stage are extensively developed in Cass, Marion and Upshur, and in a more limited way in Morris and Harrison Counties, the marine stage is also represented, and widely spread, fragmentary deposits of altered greensand and glauconitic sandstones occur within the limits of these counties. These fragmentary deposits often cover several miles of territory, and their presence is always marked by the occurrence of nodular ore and a greater or less extent of laminated ore. This is usually in the form of very thin seams interstratified with the sands or occurs in a fragmentary condition scattered on the surface and mixed with the geodes of nodular ore.

In Cass County the brownish-yellow altered greensands occur in association with both nodular and laminated ore at the Berry Crawford mine about a mile north of Atlanta. Here the section shows the nodular overlying the laminated ore and the underlying altered greensand resting directly upon the uppermost deposits of the lignitic series. This ridge extends for several miles to the north and west, and the nodular ore is found buried in the grayish and brownish-yellow sand forming the summit and sides of the ridge and overlying the laminated ore and altered sands and sandstones. The same thing occurs in the neighborhood of Linden, where the nodular ore occupies its usual position among the yellow sands overlying the beds of laminated ore. At Cusseta, in the so-called Cusseta Mountain, we have the same laminated and nodular ores associated with altered greensand.

Throughout the northwestern portion of Cass and eastern portion of Morris Counties extensive deposits of laminated ore occur overlying pyritiferous greensand. A small quantity of nodular ore is found along the margin of this plateau and occasionally among the brown and yellow sands overlying the region.

South of Avinger Station in the same county, and extending across into Marion County, heavy deposits of yellow and brownish-yellow sands containing great quantities of nodular ore occur, and the whole of this field rests upon the thinly stratified deposits of the uppermost lignitic, whose bright red and white striped beds show beneath the ore deposits near Mr. Lockett's mill on the one side, and the cuttings along the Texas and Pacific Railway on the other, and throughout this area wherever stream channels have been cut deep enough.

Throughout Marion County the same sequence of beds follows. Two miles north of Jefferson the banded lignitic is found occupying a position beneath the laminated and nodular ores. In Harrison County it is the same thing. In this county the marine or glauconitic

Tertiary is if anything more pronounced than in the counties to the north. Heavy deposits of altered glauconitic sands, sandstones and laminated ores belonging to the marine or Claiborne stage of the Eocene form a ridge extending through the centre of the county from nearly five miles east of Marshall to beyond the western line of the county and for over a mile into Gregg, where it is separated from the same class of deposits lying further west, by the broad bottom lands of the Sabine River. These deposits are more or less fossiliferous, containing the characteristic fauna of the marine beds found farther south and west, and rest directly upon the uppermost lignitic, exposures of which may be seen near Willow Switch in Gregg and at many places north and east of Marshall, in Harrison. Laminated and nodular ores occur scattered everywhere throughout this region. The yellow sand with its contained nodules occurs capping many of the secondary portions of the ridge and lies intermingled with fragments of laminated ore or forms portions of the ore deposits that lie scattered along the sides and around the base of the ridge.

There is no use, however, to multiply instances in which the two varieties of ore lie associated and intermingled with each other. To merely recount the localities would be long and tedious and require a detailed account of the whole geology and geography of the country.

It must, however, be admitted that as a general rule the heavier deposits of nodular ore occupy positions lying at relatively lower levels than the heavy deposits of laminated ores, and it also appears to be a settled condition that while extensive deposits of nodular ore overlie these beds, by far the most extensive and valuable of these nodular deposits occupy positions between the isolated ridges, or what may be said to form the broken ends of the marine beds. This, however, is to be expected, if we are to assume that these geodes or nodules with their surrounding sands are the products, or the results of, erosion and consequent destruction of the glauconitic beds. That these glauconitic beds extended many miles farther north of the positions in which we now find the main bodies there can be no doubt. Not only the points already mentioned, but many others not nearly so prominent, still exist, bearing witness to this northward extension and the enormous erosion which has taken place in the past and is still going on.

A careful examination of one or two of the most prominent of these deposits of nodular ore and the yellow and brownish-yellow sand will, I think, be sufficient to show that these are both the results of the degradation of the beds now forming the ridges. Macroscopically, this sand is the same as the heavy deposits found covering many portions of the regions in Cherokee, Rusk and Anderson Counties, in which the laminated ores have their greatest development. The nodules of ore found among these sands do not occur promiscuously scattered over the face of the country, but usually occur in pockets or irregular deposits and at a noticeably higher elevation than the general level of the surrounding country.

In saying that none of these ore deposits occurs beneath the thinly stratified uppermost lignitic beds, I do not mean to affirm that no ore occurs within the lignitic series, but simply that none of the great deposits of nodular ore in east Texas which have hitherto been assigned to that series belongs to the lignitic. Small deposits of a nodular variety of ore as well as clay ironstone do occur at several places within the lignitic beds. These, however, lie at considerable depths and are found amongst the clays and sand of that series in well digging and other deep excavations. These are not all clay iron-stones nor carbonates, as has been asserted, and throughout the extensive areas of the eastern division of the State, in which the lignitic strata form the surface deposits, no ore of any kind has yet been found. The absence of these ores from the great lignitic areas of Limestone, Robertson, Smith, Harrison, Panola and other counties certainly appears remarkable if the nodular ores of Cass, Marion and others belong to these deposits.

While the question of the age of the nodular ores may form a subject for discussion, no such doubt or difficulty besets the age of the laminated ores of the region. These are altogether from top to bottom of Tertiary age and of the lower Claiborne or marine Eocene wherever found. These ores are connected with, and form an integral part of, the marine beds, and while the heaviest deposits are always, or nearly always, found at or near the surface, the same character of ore occurs at more than one horizon and lies interstratified with the glauconitic or greensand beds. Borings, as well as numerous natural sections, have demonstrated this fact,—and by the same methods it has also been shown that these lower beds are always much thinner than the upper, or surface deposits. Besides being thus stratigraphically constructed with the greensands, the ores themselves are also fossiliferous and carry the same fauna as that found in the greensand deposits. Numerous specimens gathered from deposits both overlying and underlying these ore deposits and from the ores themselves are to be seen in the cabinets of the Geological Survey of the State.

Just why these ores should assume the forms in which we now find them is somewhat difficult to say. It is quite likely that the laminated ores were deposited with the glauconitic deposits as bog iron, and part of them, particularly the interstratified deposits, have been derived from the destruction of the glauconite, and again from the destruction of these deposits, through a process of solution, infiltration and segregation, the nodular ores have been derived. Dr. Hilgard ascribes the formation of the nodular ore found in the Orange Sand in Mississippi to the solution of the iron contained in the sand and its leaching and sinking through that deposit and segregation at the base where the solution met with an obstruction to its descent in the impervious clays of the underlying lignitic beds. If this theory holds good for the Mississippi ores it certainly has everything in its favor so far as the Texas ores are concerned. There is at least one point in favor of such a theory everywhere throughout the Texas iron region. The waters found in nearly every spring and well in the country are highly charged with iron, many of them excessively so, and many of the streams crossing the ore-bearing ridges contain this impurity to such an extent that they are absolutely devoid of animal life. The waters of these streams are of a pale amber yellow color and excessively astringent taste.

Dr. Penrose's theory that these nodules are derived from nodules of clay iron-stone found in the underlying beds by oxidation—"When the carbonate has been completely oxidized the ore is either composed of concentric layers separated by cavities or is massive on the outside and hollow inside, forming geodes or iron pots. The clay or ochre often occurring in the geodes doubtless represents the residual product left after the oxidation of the impure carbonate"—does not appear to hold good in all cases. Many of the nodules found in the regions under consideration are not filled with residual ochre, but with coarse white and yellow sand, having exactly the same texture as that in which the nodules lie ; besides some of the nodules found on the

ridge in Harrison County have their centres filled with silicious pebbly conglomerate, two conditions of existence which no known condition of carbonate of iron in the form of clay iron-stone could possibly create, even should we admit the existence of a sufficient quantity of that ore to form the vast deposits of iron as we now find them. The existence of the enormous quantities of carbonate of iron or clay iron-stone I am by no means inclined to admit. Whether the lignitic ever held such quantities I do not know, but certainly the beds as we now find them contain very little of this class of ore. The little they do contain is almost altogether a sulphide.

SORGHUM SUGAR.

BY T. BERRY SMITH, FAYETTE, MO.

It has been many years since the people in the central and northern parts of the United States began to cultivate sorghum for the purpose of obtaining molasses therefrom. The processes were such as could be employed by almost any farmer.

But it has been only a few years since experiments began for the purpose of extracting sugar from the sorghum cane.

The first appropriation made by Congress for large experiments in sorghum sugar making was during the last days of the session of 1884. Since that time, so far as we know, annual appropriations have been made and untiring efforts put forth to improve both the cane and the processes of sugar making; and the advances made in each line have been steady and encouraging.

It is our purpose to treat mainly of the applications of scientific principles, as made in the government experiments in Kansas and elsewhere.

Let us suppose the cane has been grown under the ordinary circumstances and is ready to be harvested. The usual course is then to strip and top the cane, cut it and haul it to the mill (who that has heard its creaking, can ever forget it?), there crush it and collect the juice, and then evaporate it to molasses by boiling in open pans, certain simple processes being employed to clarify the syrup more or less.

By such methods are obtained the molasses which we have all eaten and of which we can not mistake the peculiar flavor.

A brief analysis of the subject will show us that the main steps are:

1. Separation of the juice from the cane.
2. Separation of the sweets from the juice.

If we would manufacture sugar there must be a third step, viz.:

3. Separation of sugar from the molasses.

Let us treat these separately:

I.—Extraction of Juice.

Old Method: Expressing it by passing the cane between rollers.

New Method: Extraction by soaking in heated water, the process being termed diffusion.

The *topped* cane is delivered to the factory by the farmer. There it is cut into short lengths by a cutting machine, after which a fan blows away the boots, blades and trash, and then the short pieces are delivered to a shredding machine, which tears the cane into as small bits as possible.

This pulp is delivered to the diffusion battery, which is arranged in various ways, but the principle of which may be stated thus:

If hot water be poured over one jar of pulp it will soak out a certain amount of the sugar content. If this sweetened water be withdrawn and poured over a second jar of pulp, it will become still more sweet; and by passing it in like manner over a number of jars of pulp, it will finally become as rich in extracts as the original juice of the cane was, *i. e.*, it may be called cane juice.

Now in order to extract all the sweets, the first jar of pulp must be subjected to portion after portion of hot water, until there will be left in the pulp very little besides woody fibre. And so with the second jar and so with all the jars of pulp.

One can readily see that the jars or cells could be so connected that the hot water entering at No. 1 would be forced in succession through a sufficient number to attain the desired strength, and thus the process be rendered continuous. Such an arrangement is termed a diffusion battery.

If the subject has been made plain so far, we are now ready to take up the second great step.

II.—Extraction of Sweets.

Old Method: Simple evaporation in open kettles or pans, with constant skimming to remove the "scum" formed by heat.

New Method: (1) Neutralization of acids by lime; (2) Removal of surplus lime by carbonic acid gas (carbonatation); (3) Heating and skimming; (4) Settling; (5) Evaporation of clear juice under reduced pressure and temperature.

The *diffusion* juice is placed in large tanks and milk of lime added until an alkaline reaction is shown. The purpose of this is to counteract the effect of any acids that may be present. At this point in our paper it will be necessary to digress a little and introduce a small amount of chemistry.

There are in the vegetable world many products which are composed of charcoal and water, the only difference in chemical constitution being in the proportions of charcoal and water employed.

Let us look at the accompanying table:

Wood	= 6 parts carbon and	5 parts water	($C_6H_{10}O_5$)
Starch	= 6 " "	" 5 " "	($C_6H_{10}O_5$)
Grape Sug'r	= 6 " "	" 6 " "	($C_6H_{12}O_6$)
Cane Sugar	= 12 " "	" 11 " "	($C_{12}H_{22}O_{11}$)

Now if we take wood, starch or cane sugar and boil them in water with acids, they will be converted into grape sugar. It is in this way that tons and tons of starch are annually changed into syrup and sugar for household and other purposes. Almost all of the clear thick syrups used on our tables at the present day are glucose or grape sugar syrups. Such syrup is inferior to cane sugar syrup in the matter of sweetness, three pounds of cane sugar being equal to five ponds of grape sugar in this respect. You can plainly see, then, that the effect of the acids present in the diffusion juice would be to diminish the sweetness of the syrup produced by simply evaporating without their removal. Their removal is rendered easy by the use of lime, which neutralizes them by uniting with them to form insoluble compounds which settle to the bottom. Now as lime will combine with sugar also to form sucrates, it is necessary to remove any surplus lime that may be present, and this is done by blowing through the juices a stream of carbonic acid gas, which may be inexpensively obtained from the smoke stacks of the furnaces. This part of the process is known as carbonatation.

After neutralization and carbonatation, the juice is raised to the boiling point, the scum formed by heat is removed in the usual way, and then the clarified liquid is left in large tanks to settle. From these it is drawn off and is ready for concentration by evaporation. This is not accomplished in open pans because in an

open pan the pressure of the atmosphere amounts to about fifteen pounds per square inch, and in order to raise the liquid to the boiling point this pressure must be overcome. If this pressure can be overcome, or at least largely reduced, then the boiling point can be reached at much lower temperatures than 212° Fahr.

The pressure is diminished by the use of air tight pans and of air pumps. Let us suppose that coils of pipe, connected with the escape pipe of the engine, are laid in a large pan, a supply of clarified juice fills the pan, an air-tight cover is put on, and the contained air is partially exhausted by the air pump. The exhaust steam from the escape pipe of the engine is hot enough to cause the juice to boil. Now let us suppose that the steam from this pan be forced through coils of pipe laid in another air-tight pan filled with juice and more thoroughly exhausted than the first one, it is clear to see that evaporation at a still lower temperature will be secured. Such a combination as above described is called a double-effect apparatus.

A multiple effect would be a multiplication of pans so connected and manipulated that the steam of one will boil the next. The advantages in such arrangements are: (1) lower temperature and less danger of scorching the contents; (2) speed in evaporating the water from the sweets; (3) reduction of cost.

Now if syrup be the end aimed at of course the process would end when a proper degree of concentration has been reached. But if it is desired to make sugar also, then additional process must be employed.

III.—Extraction of Sugar.

Under this head we shall give in brief the methods employed with large success at the government experiment stations in 1891.

The diffusion process affords a juice containing both "sugars" and "non-sugars" in acid aqueous solution. As explained, the acid tends to convert cane sugar into grape sugar, and this is prevented by the use of lime.

The effect of the "non-sugars" is to prevent crystallization and separation of the "sugars": for this reason they are called molasses-makers (melassigenes). Their removal is necessary to the formation of a large "sugar" product. Their removal is partially accomplished in the processes of defecation, i. e., liming, heating and skimming. But there still remain "non-sugars," which are soluble in water and must be separated in some other way. This is now very successfully accomplished by the use of alcohol. The clarified juices are concentrated until they contain about 55 per cent solid matter, then mixed with an equal volume of 90 per cent alcohol, and thoroughly stirred by blowing air through the mixture.

The impurities of the syrup separate in flocculent masses, and in the course of twenty-four hours they completely settle to the bottom of the tanks, leaving a supernatant fluid that is clear and of a pleasant odor.

The next step is to draw off the clear fluid and subject it to distillation, whereby the alcohol is separated and recovered for future use. The sediment is subjected to pressure by which an alcoholic syrup is obtained and a hard cake left containing more or less of sugar and alcohol. Here is the chief loss of alcohol, but the loss may probably be more than replaced by fermentation and distillation of these "press cakes." Here, however, we encounter the United States revenue laws, and modifications would have to be made in the laws before sugar factories could proceed. In fact, the alcoholic process would require so much alcohol that it cannot be profitably employed unless the sugar manufacturer could be allowed to buy, or manufacture, and use alcohol, almost or altogether free of duty. What legislation has been had in regard to this subject we are not prepared to say.

"The syrup, freed from alcohol, was passed through the usual sugar house processes of granulation in the vacuum pan and purging in the centrifugals." (Bulle-

tin No. 34, experiments with sorghum in 1891, by Prof. H. W. Wiley.)

The sugar crystallized readily and separated perfectly in the centrifrugals from the syrup in from two to five minutes. By the processes hereinbefore mentioned the sorghum grower of the central States may compete with the grower of ordinary cane in the South. From an acre of good sorghum may be obtained a barrel of nice nearly white sugar, equal in every way to ordinary cane sugar.

The question may arise: "Can the farmer *profitably* manufacture his own sugar, *i. e.*, on a small scale?"

Probably no more than the farmer can manufacture his own woollen goods or make his own flour.

It is doubtful if cane can be profitably raised more than three miles from a central factory, and besides enough cane can be raised within two miles of the factory to supply all of its demands. Such being the fact, the central and northern States must hope to make their own supply of sugar, not by individual factories, but by a system of central factories put up on a large scale and equipped for all the steps of molasses and sugar making.

The amount of sugar consumed in the United States for the year ending June 30, 1890, was about three billion pounds (an average of fifty-five pounds per capita), and there were eighty million gallons of molasses consumed.

The United States produced about one-tenth of the sugar and one-fifth of the molasses. Hence the necessity for increasing our sugar producing crops, viz.: the southern cane and the northern sorghum and the beet.[1]

[1] To these may be added "corn cane," for a most interesting discussion of which the reader is referred to *Science* during the month of September, 1893.

—The third annual meeting of the Ohio Academy of Science was held at Columbus on Dec. 28 and 29, 1893. The usual necessary formal business was done, and papers were read on various subjects connected with geology, botany, entomology, ornithology, and a beginning was made in chemistry and astronomy, which have not previously claimed their fair share of attention. The following among the papers read may claim notice here: "On the Evolution of Indian Corn," by Mr. W. A. Kellerman; "Distribution of North American Lepidoptera in Norway," by Prof. F. M. Webster; "On Certain New and Known Marine Infusoria," by Dr. D. S. Kellicott; "Lake Licking; a Contribution to the Buried Drainage of Ohio," by Prof. W. G. Tight; "Further Study of the Wheat Scale," by Prof. A. D. Selby; "On a New Fossil Crustacean from the Water-Lime," by Prof. E. W. Claypole; "A Revision of the Lichens of Ohio," by Mr. E. E. Bogue, and "On the Nutritive Value of Common Fruit," by Prof. W. R. Lazenby. Arrangements were also completed for the organization of a Natural History Survey of the State. Three directors were appointed, Professors Claypole, Kellicott and Kellerman, whose duties were simply to enlist and arrange all the volunteer laborers who could be induced to take part in the work and aid them in the choice of fields and in the prosecution of their labors, leaving the whole method or responsibility in their hands as much as if they were independent workers. These results when obtained will be presented to the Academy, by the authors if possible, referred to suitable experts and, at the discretion of the Academy, printed in the annual report. The organization of the undertaking is the most important one of the still young academy. Prof. F. W. Webster, of the Agricultural Experiment Station, was elected president for 1894.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York]

For Sale or Exchange.—A "Troughton & Simms" bronzed metal sextant, with double-frame platinum and gold vernier; fitted to bronze standard, with balance weights attached and brass adjusting screws, with full set of tubes, both plain and inverting; an artificial horizon and all fittings necessary for observing and rating chronometers. Also the first 10 volumes of "The Forum" bound in twenty volumes (in cloth), together with two unbound volumes. Address W. S. Leavenworth, Ripon, Wisconsin.

I have Michigan shells of the unio, alalus, gibborus, ligamentinus, occideus, plicatus, pustrilorus, rubignorus, verrucosus, margaratana, marginala, rugosa, for fresh water and sea shells of other localities and varieties, copies of *Scientific American* for shells; also a few minerals to exchange. Chas. Miller, jr., 216 Jefferson st., Grand Rapids, Mich.

For Sale or Exchange.—A large number of state and general government scientific reports, Smithsonian contributions and Bulletins Torrey Club, Botanical Gazette and many others. These were obtained in the purchase of a large scientific library and are duplicates. Write for what you want and offer any sum. Mexican Boundary Survey, Torrey's Botany California, Blume's Orchids of India and Japan, and Hooker's Rododendrons of the Sikkim-Himalaya are in the lot. What offers? R. Ellsworth Call, Louisville, Ky.

Skins, with full data, of Ægialites nivosa, Ereunetes occidentalis, Ammodramus beldingi, A. rostratus, Chamæa fasciata henshawi and others from California, for native or foreign skins with full data. A. W. Anthony, 2042 Albatross Street, San Diego, California.

For Sale.—An entirely new analytical balance, made by one of the most celebrated manufacturers; capacity 100 grammes, sensitive to one-twentieth a milligramme. Never been used. Regular price, $83. Will sell for $50 cash. Address, A. P. Nichols, 41 Summer Street, Haverhill, Mass.

Wants.

Wanted.—Sachs's Text-book of Botany, 2nd English edition. Dr. Alfred C. Stokes, 527 Monmouth Street, Trenton, New Jersey.

WANTED to exchange for human bones or recent medical text-books, the following books "Metallurgy of Silver," M. Eissler, 1889; "Practical Treatise on Petroleum," by Benj. J. Crewe, 1887; "Cook's Chemical Philosophy," 1885; "Cairn's Chemical Analysis," 1880; "Wagner's Chemical Technology," by Crookes, 1886; "Fresemier's Qual. Chem. Analysis," 1879; "Elementary Treatise on Practical Chemistry and Qual. Analysis."—Clowes, 1881; bound Vols. 1 to 12 of Dr. Lardner's "Museum of Science and Art" (very rare), 1854; back numbers of "Electrical World," beautiful specimens of Pyrite Incrustations from Cretaceous of New Jersey; Magnetis Iron Ore, Highly Polarized. Address D. T. Marshall, Metuchen, N. J.

WANTED.—Books or information on the microscopical determination of blood and hair. Also reports of cases where hair has played an important part in the identification of an individual. Address Maurice Reiker, 206 N. First Ave., Marshalltwn, Iowa.

A GEOLOGIST thoroughly conversant with the geology of the Southern States desires an engagement. Has complete knowledge of the economic geology of Iron, Coal, Lignite, as well as Clay and Kaolin. Five years' experience with Geological Surveys. Address K., 509 West Sixth Street, Austin, Texas.

WANTED.—Tuckerman's Geneva Lichenum and Carpenter on the Microscope, Wiley's Introduction to the Study of Lichens. State price and other particulars. Richard Lees, Brampton, Ont.